MEIS369.001AUS

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Farhad Farassat
Appl. No.	:	10/090,083
Filed	:	March 1, 2002
For	:	METHOD OF TESTING BONDED CONNECTIONS, AND A WIRE BONDER
Examiner	:	Lynne Edmondson
Group Art Unit	:	1725

#10

CERTIFICATE OF MAILING

I hereby certify that this correspondence and all marked attachments are being deposited with the United States Postal Service as first-class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on

January 16, 2004
(Date)

Michael H. Trimholm, Reg. No. 37,743

PETITION FOR REVIVAL

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The above-identified application became abandoned for failure to file a timely and proper response to the Office Action mailed on March 25, 2003, which set a three-month period for response. The abandonment date of this application is November 24, 2003 (i.e., the day after the expiration of the date of the period set for response, plus any extensions of time obtained therefor).

Enclosed herewith is a copy of the Response and transmittal documents including a one-month request for an Extension of Time to file a Response which mailed to the U.S. Patent and Trademark Office via Certificate of Mailing on July 25, 2003.

As indicated in the Certificate of Mailing, the application was timely filed on July 25, 2003. However, the postcard was not returned nor was the check accompanying the response filed. As a consequence, the Applicant submits that the application was timely filed but was not received by the U.S. Patent and Trademark Office.

By this paper, the Applicant is petitioning under 37 C.F.R. 1.8 for reinstatement of this application and is hereby providing notice as required under 37 C.F.R. 1.8(b)(1) of the July 25,

2003 mailing and is further supplying the copy of the previous response as required by 37 C.F.R. 1.8 (b)(2). Attached herewith is a statement by James Ausley, who signed the certificate of mail, indicating that the response was timely filed. Moreover, attached herewith is a daily mail log maintained by Knobbe, Martens, Olson & Bear, LLP indicative of all of the papers filed from the Riverside office on or about July 25, 2003. As indicated in the mail log, the log indicates that a response corresponding to the attorney docket number of the above-identified case, MEISS69.001AUS, was filed on July 25, 2003.

Applicant therefore believes that a response to the Office Action was timely filed and respectfully requests revival of this application. In addition, because Applicant believes the response was timely filed and the necessary fees paid, Applicant does not believe any additional fees are required; however, if necessary, please charge any fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 1/15/04

By: _____
Michael H. Trenholm
Registration No. 37,743
Attorney of Record
Customer No. 20,995
(909) 781-9231

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010704

Docket No.: MEISS69.001AUS

Customer No.: 20,995

AMENDMENT / RESPONSE TRANSMITTAL

COPY

Applicant	:	Farhad Farassat
App. No.	:	10/090,083
Filed	:	March 1, 2002
For	:	METHOD OF TESTING BONDED CONNECTIONS, AND A WIRE BONDER
Examiner	:	Lynne Edmondson
Art Unit	:	1725

CERTIFICATE OF MAILING

I hereby certify that this correspondence and all marked attachments are being deposited with the United States Postal Service as first-class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on

July 25, 2003
(Date)

James W. Ausley, Reg. No. 49,076

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Transmitted herewith for filing in the above-identified application are the following enclosures:

(X) AMENDMENT in twelve (12) pages.

The fee has been calculated as shown below:

FEE CALCULATION				
FEE TYPE		**FEE CODE**	**CALCULATION**	**TOTAL**
Total Claims	24 - 26 = 0	1202 ($18)	0 x 18 =	$0
Independent Claims	4 - 4 = 0	1201 ($84)	0 x 84 =	$0
Multiple Claim		1203 ($280)		$0
1 Month Extension		1251 ($110)		$110
2 Month Extension		1252 ($410)		$0
3 Month Extension		1253 ($930)		$0
			TOTAL FEE DUE	**$110**

(X) An extension of time is hereby requested by payment of the appropriate fee indicated above.

(X) A check in the amount of $110 is enclosed.

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(X) Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

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MEISS69.001AUS

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Farhad Farassat
Appl. No.	:	10/090,083
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July 25, 2003
(Date)

James W. Ausley, Reg. No. 49,076

AMENDMENT

COPY

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Office Action mailed March 25, 2003 (Paper No. 8), please amend the above-referenced application as follows:

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method of testing wire-bond connections between a bonding wire and a separate surface, the connections being produced by a bonding head with a bonding tool and a wire clamp associated with the bonding tool under pressure and the action of at least one of ultrasound and heat, the method comprising:

lifting the bonding head or the bonding tool a first distance away from the bonding site after the bonded connection has been created;

fixedly gripping the bonding wire with the wire clamp; and

raising the bonding head or the wire clamp with bonding wire gripped therein for a second distance during which process the tensile force acting on the bonding wire is ~~detected~~ measured.

2. (Previously Amended) The method of Claim 1, wherein raising the bonding head or the wire clamp for the second distance is calculated, in dependence on the structural features, so that a predetermined tensile force is exerted as a result of the raising, and an intact state of the bonded connection is detected during raising.

3. (Currently Amended) The method of Claim 2, wherein the intactness of the bonded connection is determined by observing the time course of the measured tensile force acting on the wire clamp during the raising.

4. (Currently Amended) A wire bonder in which there is integrated into a bonding head a testing arrangement for wire-bond connections between a bonding wire and a separate surface wherein the bonding head comprises:

a tool holder to hold a bonding tool;

a wire-clamp holder to hold a wire clamp for gripping the bonding wire;

a drive mechanism for vertical displacement of the bonding head or tool holder and the wire-clamp holder;

a program control system to control a predetermined movement sequence of the bonding head or tool holder and the wire-clamp holder associated with the drive

mechanism in order to carry out a measurement of tensile force at the bonding wire; and

a force measuring device associated with the wire-clamp holder in order to measure a tensile force acting on a bonded connection to the bonding wire that has been produced.

5. (Canceled)

6. (Currently Amended) The wire bonder of Claim ~~5~~ 4, wherein the wire-clamp holder is mounted on the bonding head so that it can be elastically deflected against the action of a pretensioning element and a force-measurement element is associated with the holder.

7. (Previously Amended) The wire bonder of Claim 6, wherein the wire-clamp holder comprises a weakened preferential bending section or leaf-spring section, which ensures the elastic deflectability and in which the force-measurement element is located.

8. (Currently Amended) The wire bonder of Claim ~~5~~ 4, wherein the program control system induces the bonding head to lift a first distance and induces the wire clamp to grip the bonding wire and then induces the bonding head or the wire clamp to raise a second distance while the force measuring device measures the tensile force acting on the bonding wire.

9. (Previously Added) The wire bonder of Claim 4, wherein the separate surface is a bonding pad.

10. (Currently Amended) The wire bonder of Claim ~~5~~ 4, wherein the wire-clamp holder is mounted on the bonding head so that it can be linearly displaced.

11. (Previously Added) The wire bonder of Claim 6, wherein the force-measurement element comprises a strain gauge.

12. (Currently Amended) A method of testing wire-bonded connections between a

bonding wire and a separate surface having a bonding site, the method comprising:

lifting a bonding tool a first distance away from the bonding site after the bonded connection has been created;

fixedly gripping the bonding wire with a wire clamp; and

raising the bonding tool for a second distance during which process the tensile force acting on the bonding wire is measured.

13. (Previously Added) The method of Claim 12, wherein the method further comprises producing the wire connections with a bonding head, a bonding tool, and a wire clamp associated with the bonding tool.

14. (Currently Amended) The method of Claim 13, wherein producing the wire-bond connections includes producing the wire connections under at least one of pressure, ultrasound, ~~or~~ and heat.

15. (Previously Added) The method of Claim 12, wherein lifting a bonding tool comprises lifting a bonding head.

16. (Previously Added) The method of Claim 12, wherein raising the bonding tool comprises raising the wire clamp with bonding wire gripped therein.

17. (Canceled)

18. (Previously Added) The method of Claim 12, wherein raising the bonding head or the wire clamp for the second distance is calculated in a manner so as to be dependent on the structural features so that a predetermined tensile force is exerted as a result of the raising.

19. (Previously Added) The method of Claim 18, wherein an intact state of the bonded connection is detected during raising.

20. (Previously Added) The method of Claim 19, wherein the intactness of the bonded connection is determined by observing the time course of the tensile force acting on the wire clamp during the raising.

21. (Currently Amended) A wire bonder device comprising a bonding head with an integrated testing arrangement for wire-bond connections between a bonding wire and a surface wherein the bonding head comprises:

a holding tool to hold a bonding tool;

a wire-clamp holder to hold a wire clamp for gripping a bonding wire;

a drive mechanism for the vertical displacement of the bonding head and wire-clamp holder;

a program control system to control a predetermined movement sequence of the bonding head and wire clamp holder wherein the program control system is associated with the drive mechanism and carries out a measurement of tensile force at the bonding wire; and

a force measuring device is associated with the wire-clamp holder in order to measure a tensile force acting on a bonded connection to the bonding wire that has been produced.

22. (Canceled)

23. (Currently Amended) The device of Claim ~~22~~ 21, wherein the holding tool comprises a transducer holder.

24. (Canceled)

25. (Canceled)

26. (Canceled)

27. (Currently Amended) The device of Claim ~~26~~ 21, wherein the wire-clamp holder is mounted on the bonding head so that it can be elastically deflected against the action of a pre-tensioning element, and a force-measurement element or a strain gauge is associated with the holder.

28. (Previously Added) The device of Claim 27, wherein the wire-clamp holder comprises a weakened preferential bending section or leaf-spring section, which ensures the elastic deflectability and in which the strain gauge is located.

29. (Previously Added) The device of Claim 21, wherein the surface includes a separate surface.

30. (Previously Added) The device of Claim 29, wherein the separate surface includes a bonding pad.

REMARKS

In the Office Action, the Examiner rejected Claims 1 and 12-17 under 35 U.S.C. § 102(b) as being anticipated by Cray et al. (U.S. Patent No. 5,195,237). After a careful review of the Cray et al. `237 reference, the Applicant notes that Cray et al. teaches a device and method of forming wire-bond connections and in particular wire bonding gold wires to gold contact pads placed on a gallium arsenide die. Cray et al. also teaches a device and method for deforming the gold leads to form ball bonds and "accordioned" deformation of the gold lead to contact the interior of a plated hole. As noted in the Office Action, Cray et al. illustrates in Figure 2 and describes in Figures 5-6 the sequence of steps to make a flying lead bond to the packaging dye. Briefly, Cray et al. describes bringing the gold lead into contact against the pad via the capillary 100, forming a gold ball of a diameter of approximately 6 mils at the end of the wire, withdrawing the wire into the capillary 100 so as to tighten the ball against the tip of the capillary 102 and heating, applying high pressure, and ultrasonic vibration at the capillary tip so as to form the wire bond. The capillary 100 is withdrawn and an automatic notching mechanism 115 strikes both sides of the gold wire forming a notch 107. Cray et al. describes modifying a known ball bonder to measure and display the height of the notch 107. Clamp 108 then closes on the gold wire and the head is withdrawn until the gold wire breaks at the notched point. "This stretching process serves several useful purposes. Primarily, the gold wire is straightened by the stretching force and stands perpendicular to the dye surface. In addition, the bond is non-destructively pull-tested for adhesion at the bonding pad" (cf. Column 6, Lines 17-22).

The Applicant respectfully notes however that Cray et al. does not at all disclose "raising the bonding head or the wire clamp with bonding wire gripped therein for a second distance during which process the tensile force acting on the bonding wire is measured" (Claim 1 as currently amended, Claim 12 similarly amended). Presumably, the non-destructive pull-testing for adhesion mentioned in Cray et al. would admit of visual, electrical, or other inspection to determine whether the notch 107 broke with or without compromising the bonded connection, however Cray et al. clearly does not teach measuring the force applied as the clamp 108 withdraws the gold wire. Thus, as the base Claims 1 and 12 are not anticipated by Cray et al. `237 the claims depending therefrom, e.g. 13-17, are also not anticipated by Cray et al.

The Examiner also rejected Claims 1-6, 8-27, 29, and 30 under 35 U.S.C. § 102(b) as being anticipated by Kelly (U.S. Patent No. 5,894,981). Following a careful review of the Kelly `981 reference, the Applicant respectfully notes that Kelly teaches also an ultrasonic wire bonder including an apparatus for testing bonds made therewith. The Kelly device includes a forcer mechanism, a force controller 82, and a position sensor 86 (cf. Figure 3 and Column 5, Lines 19-25). Kelly `981 teaches that "the invention uses the fundamental concept of using a pull test **at a given particular pull force** to establish whether a bond has been properly made" (cf. Column 3, Lines 24-26). The employment of the Kelly device is illustrated in Figure 4 and described in further detail at Column 9 and in particular Lines 49-58. In particular, a first wire bond is made, the bonding head is moved to a pull height where clamps are closed upon the wire and "a given amount of force against the wire permits the pull test to be performed. The encoder 204 has its output recorded in an encoder recorder 205 that effectively is connected to the position sensor and control processor 94. This enables a determination whether a good bond has been made when the head lifts by virtue of the encoder either not moving which indicates a bad bond or slight movement of the wire which shows it is being paid out by virtue of the head moving upwardly while the bond remains on the substrate." If the predetermined force exceeds the strength of the bond, the operation is aborted and an error message is displayed to facilitate either adjustment of the applied force or modification of the bonding process. If the initial pull test does not exceed the strength of the initial bond, the clamps are opened and a second bond is completed. Thus, the Applicant respectfully notes that Kelly `981 employs a variable but predetermined force that clearly does not include the aspect "during which process the tensile force acting on the bonding wire is measured" (Claim 1 as currently amended). As similar limitations are included in the other base Claims 4, 12, and 21, the Applicant believes that those claims as well as the claims depending therefrom are patentable under 35 U.S.C. § 102(b) over Kelly '981.

The Examiner also rejected Claims 1-5, 8-10, 12-26, 29, and 30 under 35 U.S.C. § 102(b) as being anticipated by Price et al. (U.S. Patent No. 5,591,920). Following a careful review of the Price et al. `920 reference, the Applicant notes that Price et al. `920 teaches a diagnostic wire bond pull tester and methods of utilizing the same. The Price et al. device is provided with a control for automatically applying increments of pull force on a fine wire after making a bond.

The control senses the elongation of the fine wire as a result of the force applied and is capable of terminating the pull test at a predetermined threshold value or continuing to increase the force until a break occurs (see abstract). The teachings of Price et al. '920 include a stress versus strain diagram shown in Figure 4 for a piece of fine wire when being stressed to failure, the values shown being for a 1 mil gold wire (Figure 4 and Column 4, Lines 37-40). There are no teachings or suggestion in the Price et al. reference that this stress versus strain diagram of Figure 4 has been determined by the Price et al. device itself and it is apparent that this diagram has been experimentally determined by other means and is utilized by the Price et al. '920 device as a comparative reference.

The utilization of the diagram of Figure 4 is explained in greater detail with reference to Figure 7 of Price et al. and is described in Column 6, Lines 1-43. "The next step is to raise the bonding tool 15 to a Z0 predetermined height or kink height as shown in block 82. ... After rising to kink height, the wire clamps 19 are closed as shown at block 84. The first continuity check is performed subsequently at block 85. If the continuity check is positive and the wire clamps are closed, it is now possible to increase the pull strength by increasing an increment of current to the Z-drive motor 10 as explained here and before and shown at block 86. After applying the new pull strength force, a comparison test is made at block 87 which effectively determines whether the Z-height now minus the Z-height before (Z0) has increased to the point where it equals a predetermined Z maximum which occurs between points 38 and 39 as shown in Figure 4. If the pull force is still performing correctly, the elongation is on the linear portion of the curve shown in Figure 4 by points 37 and it is possible to make the next logical test is optional as shown at block 88."

It is clear from the teachings of Price et al. '920 that no direct measurement is made of the force applied by the bonding tool to the wire during the pull test. At best, Price et al. '920 can inferentially estimate the force applied however this estimation is subject to multiple sources of error including the accuracy of the stress strain diagram of Figure 4, the correspondence between the actual wire being used by the Price et al. device and the 1 mil gold wire evaluated in the reference stress strain diagram, the accuracy of the establishment of the initial Z_0 position, the change in the Z-height as subsequently measured, and the true initial force applied at the Z_0 position. The Applicant further notes that the teachings of Price et al. '920 do not include any

perform a clamping function. Ringler `448 teaches that the clamps 210 and 212 are arranged to facilitate movement of a cutter blade 270 into close proximate relationship with the end or tip 282 of the bonding tool 278 to provide for the closest practical cut off of the wire that has been bonded near the tip 282.

The Applicant respectfully notes however that Ringler `448 lacks any teaching of force measurement and in particular clearly lacks the aspects of the Applicant claimed invention of "raising the bonding head or the wire clamp with bonding wire gripped therein for a second distance during which process the tensile force acting on the bonding wire is measured" (Claim 1 as currently amended) as well as "a wire bonder...wherein a force measuring device is associated with the wire clamp holder in order to measure a tensile force acting on a bonded connection to the bonding wire that has been produced" (Claim 4 and 21 as currently amended). The Applicant thus believes that the base claims 1, 4, and 21 as well as the claims depending therefrom are patentable under 35 U.S.C. § 102(b) over Ringler.

Although in the Office Action the Examiner has not so asserted, the Applicant further notes that there is nothing in the teachings of the Cray et al. `237, Kelly `981, Price et al. `920, or Ringler `448 references to suggest the desirability of the Applicant's claimed invention. The Applicant further notes that even if provided with such motivation, the teachings of the references taken individually or in any possible combination would still fail to teach the Applicant's claimed invention. Thus, again, while the Examiner has not so indicated in the Office Action, the Applicant believes that the invention as currently claimed is patentable under the requirements of 35 U.S.C. § 103 in light of the combined teachings of the art of reference.

SUMMARY

From the foregoing, the Applicant believes that the pending base claims 1, 4, 12, and 21 as currently amended are patentable under the requirements of 35 U.S.C. § 102 in view of the Cray et al. `267, Kelly `981, Price et al. `920, and Ringler `448 references and that thus the respective dependant claims depending therefrom and further defining the Applicant's invention are likewise patentable under the requirements of 35 U.S.C. § 102. Thus, the Applicant believes that the subject application as currently amended is in a condition ready for allowance and respectfully requests the prompt issuance of a Notice of Allowability. The Applicant believes that this amendment is fully responsive to the rejections raised by the Examiner in the Office Action, however should there remain any further impediments to the allowability of this application that might be resolved by a telephone conference, the Examiner is respectfully requested to contact the Applicant's undersigned representative at the indicated telephone number.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 7/25/03

By: _____

James W. Ausley
Registration No. 49,076
Agent of Record
Customer No. 20,995
(909) 781-9231

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Knobbe, Martens, Olson & Bear LLP, 3403 Tenth Street, Suite 700, Riverside CA 92501
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WWEL64.001C2		RR006746113US	"	11.65
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UTILITY/DESIGN PATENT
(amend/final amend/appeal)

Date: July 25, 2003
Date of Action: 3/25/2003

Rec'd in the USPTO on the date stamped hereon via Certificate of Mail:
Docket #: MEISS69.001AUS Applicant: Farhad Farassat
Title: METHOD OF TESTING BONDED CONNECTIONS, AND A WIRE BONDER
App No.: 10/090,083 Filed: 3/01/2002
VERIFIED BY: Asst: A.Cogar Atty: JWA QC: _____

- ☒ Transmittal Letter
- ☒ Amendment in 12 pgs
- ☒ 1 Month Extension Requested
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